# *Victim Selection and Kinematics: A Dynamic Point-light Assessment Of Perceived Vulnerability to Attack*

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# *Abstract*

Grayson and Stein (1981) argued that movement style specifies vulnerability to physical attack. The current study investigated this claim using a rigorous point-light methodology, which isolates kinematic information. Thirty women were filmed using point-light methodology, walking across a darkened room. This videotape was then played to perceivers with contrast increased and brightness decreased, such that they could only see a configuration of bright lights moving against a dark background; static geometric structure was lost and only movement was visible to the perceiver. The women were rated by 30 male and 30 female perceivers in terms of how easy or difficult they would be to mug and rape. These ratings demonstrated that perceivers could differentiate walkers according to ease of attack solely on movement cues. A number of walking style characteristics were found to be associated with ease of attack for both mugging and rape. Women were significantly more likely to be perceived as vulnerable if they lifted their feet, or walked slowly, had limited arm swing, short-medium stride length, inhibited gestural movement, predominantly lateral or forward-back weight shift, were lethargic and relatively heavy. Walking speed and foot movement were identified as being independently predictive of ease of attack. Despite the ability to discriminate between walkers in terms of perceived vulnerability, participants displayed limited awareness as to the extent to which different walking style features influenced their ratings of perceived vulnerability. These results support and extend those obtained by Grayson and Stein (1981) and are discussed within an ecological framework. Theoretical and practical implications of these findings are considered.

# *Chapter 1: Introduction*

## *CRIMINAL VICTIMISATION.*

It is well established that the risk of personal criminal victimisation is not random, and varies dramatically as a function of personal demographics, including age, sex, marital status, income, race and place of dwelling. Studies from the United States, Great Britain, and New Zealand are in broad agreement as to the groups most at risk. They have found that the young are more at risk than the elderly, males more than females, single, divorced, or separated persons more than married persons, the poor more than the rich, blacks more than whites, and urban dwellers more than rural dwellers (Empey, 1982; Gottfredson, 1981; Harland, 1995; Hindelang, Gottfredson, & Garofalo, 1978; Laub, 1990; Sampson, 1987). Taken together, the research indicates that the persons most at risk are young, single/divorced/separated, poor, black, city living males followed closely behind by the equivalent groups of white males, and black females (Feldman, 1993).

Another consistent non-random pattern is evident with regard to instances of repeat criminal victimisation. Small proportions of the population suffer the majority of offences (e.g., Gottfredson, 1984; Young, 1997), and once a person has experienced an episode of victimisation the chances of a further victimisation increases with each subsequent incident. In other words, incidents of victimisation are interdependent (Ellingworth, Farrell, & Pease, 1995; Hindelang, et al., 1978). Often those who are repeat victims are offended against by a number of different offenders, therefore indicating that there is something about the victim which suggests inherent vulnerability since more than one offender chooses to attack them (Farrell, Phillips, &

Pease, 1995). In New Zealand, Young (1997) reported that 6% of the population experienced 68% of violent and sexual crimes. These multiple victims reported an average of 12 incidents during 1995, for mainly violent and sexual offences, and were most likely to be women of Maori and Pacific Island descent. Similarly, Gottfredson (1984) found that 14% of British adults reported 70% of all victimisation incidents.

The non-random nature of victimisation statistics has led some researchers to propose that certain people are more victim-prone than others, and to date the literature supports this contention (Gottfredson, 1981). Suggested reasons for this non-random pattern are that there is either something about the victim that changes once they have been victimised, thus encouraging further victimisation (Sparks, 1981), or that there is something inherently vulnerable about the victim, regardless of past experiences (Farrell et al, 1995; Feinberg, 1980; Groth, 1979; Lauritsen & Davis Quinet, 1995; Myers, Templer, & Brown, 1984; Reiss, 1980; Selkin, 1975; Sparks, 1981). It is the second of these suggestions that will be the focus of the research reported here.

Despite the fact that males are more at risk than females from criminal victimisation in general, there are some types of crime for which females face higher risks. Women encounter far higher rates of sexual assault than men, and are prominently represented in personal theft statistics; a sex difference which may be due to the relative ease with which an offender can snatch a woman's handbag compared to stealing a man's wallet (Brewer, 1994; van Dijk, Mayhew, & Killias, 1990). The focus of the current study will be on the female victims of physical (mugging) and sexual assault, perpetrated by male strangers. The current study aims to identify characteristics of females (potential victims), which specify vulnerability to attack from male strangers. The focus will be

on females' movement style and the impact of this style on observers' perceptions of vulnerability. It is recognised that victim characteristics are not the only factors influencing victim selection; situational factors, and characteristics of offenders also play an important role, but these (except for measures of sexual aggression) are beyond the scope of the present study. It also needs to be stated that the ability to perceive vulnerability is distinct from the propensity to act on these perceptions. That is, somebody's ability to perceive vulnerability in another does not necessarily mean that they will attack that vulnerable person. Why some individuals choose to commit such crimes is a distinct area of research and is not considered here.

## *VICTIM SELECTION AND PERCEIVED VULNERABILITY.*

The fact that some people are particularly vulnerable to being victimised assumes that offenders either consciously or unconsciously select particular targets, selecting those they perceive as easiest to attack. In other words, that offenders are capable of, and indeed do, implement functional decision making processes. Offenders may even show improvement at selecting victims with experience by attending to cues which have been characteristic of women who were vulnerable or did not resist in the past (Selkin, 1975). Wilkins illustrated this point clearly:

> "Let any (non-criminal) reader try to imagine himself (sic) in the position of being required to commit a crime - say one of the most common crimes like larceny or breaking and entering - within the next twelve hours. Few readers would select the victim completely at random, unskilled at victim selection though they might be. There will be something approaching rationality in the selection of the victim."
> Wilkins, L. (1965) cited in Gottfredson (1981), p. 716.

A substantial amount of research has supported Wilkins' claim about the rationality of victim selection (e.g., Amir, 1971; Fattah, 1991; Hindelang et al., 1978; LeJeune,

1977; MacDonald, 1975; Selkin, 1975; Stevens, 1994). Fattah (1991) for example, contends that targets are not chosen randomly; some people are preferred over others, and has suggested several factors that offenders take into account when selecting a victim.

The perceived manageability of the victim refers to the ease with which the offender believes he/she can overpower a potential victim without endangering themselves (Fattah, 1991), and is especially important in face-to-face crimes such as rape, robbery, and mugging. Offenders prefer 'easy' targets, ones that are vulnerable, unlikely to resist, unprotected and unarmed, thereby maximising their chances of success, and at the same time minimising their chances of getting hurt or apprehended. To ensure a successful attack, the perpetrator must be able to control the victim and counter any resistance, and therefore must consider several factors: the ease with which the victim can be intimidated, the likelihood that they will resist, and the prospect of having to use force to control the situation and gain acquiescence. With respect to mugging, LeJeune (1977) noted that male offenders often base their decision whether or not to offend against a potential target on the basis of instinctive assessments of them. He also found that of paramount importance to the mugger was the fear that he would not be able to control his victim, and that he might be apprehended or injured as a result. In order to minimise this risk, the majority of muggers mentioned attempts to seek out vulnerable victims. Persons most likely to be targeted were those perceived as unlikely to resist an attack (Farrell et al, 1995; LeJeune, 1977), whilst also likely to produce an acceptable monetary reward. Respondents reported things such as "I would look for somebody I know I can take, who got money", and "(we) just take our time until we see somebody that we think

that wouldn't give us no trouble, and have some money" (LeJeune, 1977, p.134).

In terms of rape, both Selkin (1975) and Hindelang et al. (1978) refer to offenders actively searching for victims who cannot react swiftly, or appropriately in the face of attack. Selkin (1975) reported that offenders may target old, handicapped, or intoxicated women because of their slower reaction times, and reduced strength. The vincibility of a person to attack whilst under the influence of alcohol or drugs is also noted by Hindelang et al. (1978).

In addition to the victim selection factors detailed above, another finding has emerged from the literature. Despite the evidence of strategic victim selection amongst rapists and muggers, the perpetrators were unaware of the cognitive processes involved in their selections, as well as the factors on which they based their decisions (Amir, 1971; LeJeune, 1977; MacDonald, 1975). Many offenders believed they chose victims at random as suitable opportunities arose, despite consistently describing attacks on the same types of victims. In contrast to these findings, Chappell and James (1986, cited in Fattah, 1991) reported an apparently high level of awareness in rapists with respect to victim selection. The majority of rapists argued that they knew the type of women they wanted to attack, as well as the most suitable locations for locating these women and completing their crime. Most described their ideal victim as the "American Dream Woman"; a nice, friendly, young, pretty, middle-class, white female between the ages of fourteen and forty-five, and between five foot two inches and six foot in height. Interestingly, the ideal victim described by these men is at odds with the composite picture of the typical rape victim painted by Katz and Mazur (1979), based on vast empirical evidence. The victim they describe is a "young, black,

unmarried female from the lower social classes who is still attending school" (Katz & Mazur, 1979, p. 44). In many respects this represents the opposite of the ideal victim reported by the rapists. It would appear then, that the rapists were either not aware of the actual features of potential victims to which they responded, or were constrained by situational variables, such as availability. Since offenders are unable to reliably identify the cues they attend to when selecting a particular target, systematic research, such as the current study, is needed to identify potential vulnerability factors.

Despite their consistent reports that the ideal victim is one that is least likely to resist, LeJeune (1977) reported that muggers were unable to reach a consensus as to the specific characteristics of vulnerable targets. For example, while some respondents reported preferring middle-aged or young men, others predominantly targeted women or the elderly. This lack of agreement in terms of preferred victim can be interpreted in several ways. First, the offender's personal and social characteristics may affect their choice of victim. Second, situational variables, such as the environment and opportunity may influence victim selection (Richards, 1991). That is, the ideal or preferred victim may not be available to the offender at that time or place. Finally, it is possible that offenders are attending to hidden cues beyond the obvious features of age and sex considered by LeJeune (1977), cues such as nonverbal behaviour. It is possible, therefore, that although the muggers in LeJeune's study demonstrated a lack of agreement as to their preferred victims in terms of age and sex, there may be a common variable across the victims that was not considered. As a result, the consensus amongst offenders in selecting victims may actually be higher than it appears. The suggestion that offenders may attend to cues previously believed to be 'hidden' warrants further investigation and is discussed below.

***PERCEIVED VULNERABILITY AND NON-VERBAL CUES.***

Several researchers have identified non-verbal cues as indicative of perceived vulnerability (Mehrabian, 1981; Stevens, 1994; Weisfeld & Beresford, 1982). Stevens (1994) focused on the victim selection techniques of incarcerated predatory rapists. Based on the interviews conducted with these inmates, Stevens determined that predatory rapists predominantly attacked females that they perceived to be vulnerable. In defining vulnerability, many references were made to non-verbal cues, such as the way women carried themselves, and their demeanour. These non-verbal cues influenced the offenders' perceptions of the woman's defensive attitudes and abilities (Stevens, 1994). For example, women who walked on their heels instead of their toes were perceived as unfit and therefore unlikely to run or put up any resistance. Other women signalled their vulnerability by appearing to be unaware of their surroundings, or by looking away or down when approached by a stranger. These women were perceived as unlikely to be able to handle themselves, and as easily dominated.

The evidence presented so far has demonstrated that motivated perceivers can and do form differentiated impressions of vulnerability about people, and that non-verbal cues play an important role in these impression formations. The next section refines the connection between perceived vulnerability and non-verbal cues further, focusing on the walking style of potential victims.

***PERCEIVED VULNERABILITY AND WALKING STYLE.***

Grayson and Stein (1981) investigated the hypothesis that some people appear to be easier to attack than others. After analysing people's walking styles and collecting perceptions of these movements they came to the conclusion that victims convey

vulnerability through their movement:

> "Potential victims may be signalling their vulnerability to would-be assailants through gestures, posture, and exaggerated movements."
> Grayson & Stein, 1981, p.68

Grayson and Stein unobtrusively videotaped people walking away from the video camera, down a busy New York street during daylight hours. The videotapes were shown to a group of twelve prison inmates convicted of assaultive crimes against strangers. The inmates were asked to discuss the assault potential of each of the targets, and from these discussions, a 10-point rating scale was constructed.

Another group of convicted muggers then viewed the video-taped targets and rated them in terms of assault potential on the 10-point rating scale, where 1 represented a very easy victim ("A very easy rip-off.") and 10 represented a very hard victim ("Would avoid it, too big a situation. Too heavy."). Targets who had been rated as easy (i.e., ratings of 1-3) by more than half of the respondents were categorised as the victim group, while targets rated as hard (i.e., ratings of 4-10) by more than half of the respondents were labelled as the control or non-victim group.

The walking styles of the targets in the victim and non-victim groups were coded and analysed in terms of a 21 movement category Labananalysis code, a method of movement notation used for the study of non-verbal communication (Laban, 1972; Laban & Lawrence, 1967). The movement categories ranged from arm and leg movement, to posture, to walking tempo (see Appendix D for details of each movement category). Analysis revealed that the victim and non-victim groups could be differentiated on only 5 of the 21 movement categories: stride length, type of weight shift, body movement, type of walk, and foot movement. Overall, the

prototypical victim, tended to walk with either an exaggerated short or long stride length relative to their height; with either a lateral, up/down, or forward/back weight shift; with a unilateral body movement (moving one side of the body at a time); with a gestural type of walk (movement initiated from the periphery); and to lift their feet. Prototypical non-victims on the other hand tended to walk with a medium stride length relative to their height; a three-dimensional weight shift (where the pelvis moves in a spiral motion); with a contralateral body movement (each side of the body moving in counter-point, that is moving opposite arm to opposite leg); with a postural type of walk (where movement is initiated from the centre of the body); and to swing their feet. The major difference reported by Grayson and Stein between the victim and non-victim profiles pertained to the type of walk, or to what extent the whole body is activated by a movement. Victims tended to walk gesturally, as though the parts of their body were moving at odds with one another, while non-victims all walked posturally, with a consistency of movement; a sense of synchrony.

Whilst respondents indicated during interviews, that they were not cognisant of the movement characteristics which influenced their perceptions of vulnerability, they acknowledged that any person who looked distinct, that is, anyone who dressed or presented themselves differently from the normal standard, would be more likely to be perceived as a potential target.

Murzynski and Degelman (1996) aimed to strengthen and extend Grayson and Stein's findings by demonstrating a causal relationship between walking style and perceived vulnerability to attack; namely sexual assault by strangers. The authors used four of the movement categories identified by Grayson and Stein (1981) as important

components of perceived vulnerability, and constructed three separate walking styles known as Victim Profile A, Victim Profile B, and Non-Victim Profile. The movement categories included were stride length, type of body movement, weight shift, and foot movement. Type of walk was not included in the walking profiles, despite Grayson and Stein (1981) identifying it as the major differentiating factor in movement style between victims and non-victims. Victim Profile A was defined by an exaggerated stride length relative to height, lateral weight shift, unilateral body movement, and lifted foot movement. Victim Profile B was identical except for stride length, using a short as opposed to a long stride length relative to height. The Non-Victim profile was defined by a medium stride length, three-dimensional weight shift, contralateral body-limb movement, and swinging feet. Three women targets, all of comparable attractiveness and identically dressed, were then trained to move in accordance with these different walking styles.

The respondents, male and female undergraduate students and traffic police officers, made perceived vulnerability and perceived confidence ratings for each of the three walking styles from a colour video tape. The results revealed no significant difference between the student and police samples, or between males and females for either the vulnerability or confidence ratings. However, the results did reveal a significant difference between the Victim and Non-Victim profiles as hypothesised. Targets walking in accordance with Victim profiles A and B were perceived as more vulnerable to attack and as less self-confident than targets portraying the Non-Victim profile. No difference in perceived vulnerability or confidence was evident between Victim profiles A and B; profiles with both exaggerated short or long stride lengths conveyed a perception of relative vulnerability and lack of self-confidence.

To summarise, it appears that some people are perceived as being especially vulnerable to physical attack. The literature suggests that offenders are attending to certain victim characteristics, including non-verbal cues such as movement style. The ecological approach and affordance theory (Gibson, 1966, 1977, 1979) provides a theoretical framework within which this research can be interpreted and developed systematically. The following sections will outline the key tenets of the ecological approach, and Runeson's (1985, 1994; Runeson & Frykholm, 1983, 1986) Kinematic Specification of Dynamics Principle. This discussion will provide a platform for the interpretation of the victimisation research and an introduction of the point-light technique; a rigorous method used for testing the perception of movement.

## *THE ECOLOGICAL APPROACH.*

J. J. Gibson (1966, 1977, 1979) developed the ecological approach as an alternative to the traditional cognitive approach to perception. The ecological approach asserts that perception is direct, that perception can occur without the need of any mediational cognitive processes, such as memory, inference, or imagination (Mace, 1977). The ecological approach holds that perceivers are able to detect useful information directly, provided they are sensitive to that information, without having to actively construct it from fragmentary pieces of data (Bruce & Green, 1985). This approach is concerned with what information is detected, rather than the perceptual processes involved in the detection of that information. This approach also purports a mutually constraining relationship between the perceiver and their environment. Perception is considered to function as a product of evolution, it being in an individual's best interests to detect the most ecologically significant information. This approach also holds that perception and action are closely united. Perception of environmental

properties provides opportunities for action and being acted upon (Gibson, 1979).

Three fundamental tenets of the ecological approach are the unit of analysis, the specification of information through events, and the notion of an active perceiver. The unit of analysis employed by this approach is the perceiver-environment interaction, which contrasts with the emphasis placed by the traditional cognitive approach on the cognitive inferential processes of the individual perceiver. The perceiver and the environment are considered to be interrelated, "each shaped by the other" (Michaels & Carello, 1981, p. 43). The social environment structures itself to best match the requirements of the perceiver in a number of ways. For example, university lecturers either directly or indirectly announce their accessibility to their students. The social environment directly indicates that they are accessible if their office door is open, or indirectly if they have specified office hours. This notion of the perceiver-environment interaction also fits with the tenets of the specification of information through events and the notion of active perceivers.

Information obtained from the environment is typically specified through events; these can be dynamic interactions with objects, places, and surfaces in the environment as well as other persons. Although information is also perceivable from static displays, (for example colour, size, and texture), the information detected from events in social and physical environments is supplementary to that obtained from static displays (McArthur & Baron, 1983). For example, a person's limp is not apparent under static conditions, but is revealed in motion. Information gained from events is generally considered more valuable and informative in terms of social perception than static displays, because of the opportunities to explore and test the

environment. With respect to people, events provide an opportunity to explore other people, and detect properties that can only be perceived through interaction. The actions, behaviours, and movements expressed by a person during their interaction with another, elicits corresponding actions, behaviours, and movements that would not have been available from a static display (Berry & Misovich, 1994). Studying event perception as advocated by the ecological approach may reveal more than the traditional approach, where the response of perceivers to static displays is investigated.

Emphasis is placed on the active, exploratory role of the perceiver. The more active a perceiver, the greater the likelihood of veridical information detection. For example, a truer indication of the weight of an object is gained by lifting the object oneself, or by observing someone else lift it, than simply by perceiving it in a static state (McArthur & Baron, 1983). By actively exploring the environment, a perceiver increases the likelihood of creating an event, potentially resulting in the revelation of more information. In addition to the revelation of new information, the perceiver is likely to adapt their behaviour in response to the action opportunities presented by the environment. For example, talking to a stranger is likely to elicit a response, revealing additional information about that person, which would not be provided simply by observing the stranger. In turn, the stranger's response will influence any further interactions. A friendly response from the stranger will likely encourage conversation, while an unfriendly or hostile response is likely to halt conversation.

The ecological approach holds that perceivers attend to the action and interaction opportunities provided by the environment, information termed by Gibson as

affordances. The term affordance was invented by Gibson (1966) to refer to the action and interaction opportunities provided to the perceiver by the environment. Gibson defined the affordances of the environment as "what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill" (1979, p. 127, original emphasis). He maintained that the affordances of an object in the environment are revealed through interaction with the object and the object's physical characteristics (Gibson, 1979), hence the emphasis on an active perceiver. The perceiver detects useful information from the environment, and as a result, the environment and perceivers adapt to each other. For example, flowers of insect-pollinated plants have evolved in distinctly different ways than flowers of wind-pollinated plants. Flowers relying on pollination by bees have evolved to require the bee to be exposed to the pollen when gathering nectar, whereas, wind-pollinated flowers have evolved to expose the pollen to the wind (Michaels & Carello, 1981). The bees, on the other hand, have evolved to recognise and pollinate these flowers. In terms of people and the environment adapting, people living in hot climates have evolved to have dark skin pigments, therefore protecting themselves from excessive sunburn. Similarly, the housing in these climates is designed to afford greater shade and ventilation than houses in cooler climates.

Affordances are invariant; an "object offers what it does because it is what it is" (Gibson, 1977, p. 78). Affordances do not change as the needs of the perceiver change (although affordances may change over time), but are always there to be perceived (Gibson, 1977). However perceivers may not always perceive these affordances. The needs and sensitivities, or attunements, of the perceiver influence whether a particular affordance is perceived on a given occasion. Affordances detected by some perceivers

may not be detected by others in the same situation. For example, a metal bar may afford hitting for one person but not for another person. Similarly, the same person may detect different affordances of the same object in different situations. For example, when planting a shrub, a garden spade affords digging, but when confronted by an assailant the same spade affords hitting. These differences in perceived affordances are reflective of the individual's attunement to those affordances. Greater attunement to an affordance means that affordance is more likely to be detected. For example, a builder may be more likely to perceive the affordance of shelter among a pile of wood than a non-builder.

The perceiver's biological make-up, intentions, moods, personal experiences, goals, expectations, and actions influence attunements to affordances (McArthur & Baron, 1983). Permanent and more long-term factors, such as biological make-up, past experiences, and goals, have different effects on attunement to affordances than do temporary influences, such as moods, intentions, and expectations. For example, especially good eye-sight and hearing results in an individual being especially sensitive to visual and auditory cues throughout their life-time (McArthur & Baron, 1983), whereas mood can influence attunement on a day-to-day, or even hour-to-hour basis. Different needs and expectations necessitate different attunements. For example, a person who is being confronted by an aggressor is more likely to perceive a shovel as affording protection, than as a tool for digging the garden. Similarly, a woman who wants to have a family will be more attuned to cues that specify that a man would be a good provider and protector for his family, than a young woman in search of fun and adventure. However, it is not always easy to detect affordances accurately; things may not afford the opportunities they appear to (Gibson, 1979). For

example, a woman may perceive a man at a party as affording a sexual relationship, when in fact he is gay. Similarly, a man may perceive a woman as affording sexual relations, when in fact the woman is a man in drag.

Sensitivity to specific affordances increases with practice, and by learning from past experiences. The perceiver learns to successfully perceive affordances with greater speed and accuracy as they gain more perceptual experience. For example, they learn to distinguish flirting from friendly behaviour, shyness from disinterest, and boredom from indifference, by focusing on things that were successful last time. As noted previously, offenders may improve at selecting victims with experience, by attending to cues that were characteristic of vulnerable women in the past (Selkin, 1975).

It is important to note that the theory of affordances does not account for causation. Whilst affordances provide opportunities for action and interaction, "whether the animal takes up these opportunities or not is a separate matter" (Reed, 1996, p. 108). For example, although a woman at a party detects that the man she is talking to affords having sex with, she will not necessarily have sex with him for a variety of reasons. Similarly, an open window affords entry into a stranger's house, however not all observers will act on this affordance. Action depends on the perceiver's intentions, goals, and motivations. Although the issues of why and when perceivers act on affordances are important, they are beyond the scope of this research.

Little systematic investigation has been made into the features that specify affordances in the social domain (e.g., flirting, and vulnerability to attack). In addition, because so much information is available to perceivers in events, any effort

to identify the specifiers of affordances necessitates the systematic isolation of these characteristics to identify their specific contributions to perception. One feature that may be important in specifying social affordances, and which is the focus of the current research, is movement, as articulated in the Kinematic Specification of Dynamics principle (KSD principle) (Runeson, 1985, 1994; Runeson & Frykholm, 1983, 1986).

"The KSD principle entails that properties pertaining to a person that have a *dynamic* ("causal") role in the generation of his or her movements are specified by the resulting kinematic patterns" (Runeson, 1994, p. 386). That is, the causes of movements are perceivable from the movements produced. The term kinematics has been defined as "motion", with dynamics as "motion explained in terms of what causes and constrains it" (Runeson & Frykholm, 1983, p. 587). The dynamic factors which influence movement are both permanent (for example, a person's geometrical and mechanical proportions, that is, their anatomical make-up), and temporary (for example, dispositional properties, such as expectations and intentions, previously considered to be hidden) (Runeson, 1985). In other words, a person's dynamics, both fixed and temporary (Runeson & Frykholm, 1983) are directly perceivable in their movements; that is, movements specify their causes. The kinematic pattern observed in an event is a true and necessary reflection of the dynamic factors underlying that event. The KSD Principle also contends that dynamics largely constitute affordances (Runeson & Frykholm, 1983). The KSD principle relies on events; that is, kinematic specification is reliant on vigorous whole-body movements (Runeson & Frykholm, 1983), such as walking, running, dancing, or engaging in an interaction.

Each person's anatomical make-up and levels of motor control and coordination are unique, thereby providing a basis for recognising people by their movements alone. Recognition can be made in terms of individual identity, such as friends and family (Cutting & Kozlowski, 1977), and categorical membership, such as sex (Kozlowski & Cutting, 1977; Runeson & Frykholm, 1983), and age (Montepare & Zebrowitz-McArthur, 1988). Intentions and expectations can also influence kinematics by affecting the body's state of action-readiness. For example, the expectation that an object will be heavy to lift will result in a kinematic pattern distinct from one in which the actor expects to lift a light object (Runeson & Frykholm, 1983). Observers are also able to reliably detect actors' intentions, whether they are true or deceptive. For example, perceivers could detect when actors were attempting to walk like members of the opposite sex (Runeson & Frykholm, 1983). Because of the multitude of movements capable of being generated by the body, it is subsequently impossible to reproduce the dynamic structure surrounding an event, in order to recreate a specified kinematic pattern and consequently, deception should not be possible. Personality and emotions are also potentially perceivable in movement (Runeson, 1985). Men and women can be discriminated on measures of submissiveness and dominance based on posture and other nonverbal cues, such as arm and leg swing movements (Richards, Rollerson, & Phillips, 1991; Weisfeld & Beresford, 1982). Emotions, such as happiness, sadness, anger, and pride have also been identified from gait information at better than chance levels (Montepare, Goldstein, & Clausen, 1987).

## *PERCEIVED VULNERABILITY AND WALKING STYLE: INTERPRETATION FROM AN ECOLOGICAL APPROACH.*

Although not identified by any of the studies discussed above, the ecological approach

and the KSD Principle provide a strong theoretical basis for the present area of investigation. The ecological approach (Gibson, 1977, 1979) can explain that some people afford attacking more than others, and that this vulnerability affordance is specified by movement cues.

Grayson and Stein (1981), and Murzynski and Degelman (1996) claimed that vulnerability to attack can be specified by walking style, or gait. Participants in both studies were asked to make ratings of perceived vulnerability after viewing targets walking down a street or path; they were able to differentiate targets on the basis of ease of attack. That is, in the terminology of the ecological approach, some of the targets afforded attacking (easy victims), while others did not afford attacking (non-victims). Both Grayson and Stein (1981), and Murzynski and Degelman (1996) claimed that walking style specifies vulnerability; that high vulnerability to attack leads to a distinctive style of walking that can be perceived by others. This fits with the KSD Principle which states that movements specify their causes. Runeson and Frykholm (1986) contend that when events are perceived "*we do not see movements as such*" (p. 272, original emphasis), but rather the dynamics underlying the movements. Vulnerability rather than an exaggerated stride length, lifted feet, gestural, unilateral, or up/down, forward/back, or lateral movements is detected by perceivers (Grayson & Stein, 1981). Grayson and Stein asked participants on what basis they were making their judgements of vulnerability. Participants were not consciously aware of the importance of specific movement characteristics in specifying vulnerability to attack; participants' explanations for why targets were perceived as easy were based on the way the targets looked, rather than any features of their movement styles.

Grayson and Stein (1981) recruited male prison inmates convicted of assaultive crimes against strangers as participants, whereas Murzynski and Degelman (1996) recruited male and female students and police officers. All three groups of participants were equally able to differentiate targets on the basis of perceived vulnerability; suggesting that all perceivers are able to detect vulnerability regardless of their background or occupation. This finding fits with the ecological approach, which holds that affordances are always available to be perceived dependent on the attunement of the perceiver. However, it is important to note that in both these studies, and in the current research, participants were directed toward differentiating walkers on the basis of the extent to which they afforded attacking. Whether perceivers, when not so directed, differ in their attunement to vulnerability and whether such attunement differs as a function of permanent (e.g., offence history) and/or temporary (e.g., situation) factors are important research questions, but are beyond the scope of the present investigation. In addition, the fact that non-offenders (i.e., those unlikely to attack) can detect vulnerability emphasises a lack of causation; the perception of an affordance is not automatically linked to action.

The conclusions drawn by Grayson and Stein (1981), and Murzynski and Degelman (1996) are consistent with the contentions of the ecological approach and the KSD principle but there is a serious methodological flaw in both studies. Neither study implemented a sufficiently stringent or appropriate methodology. In order to rigorously test the premise that movement specifies vulnerability, it is necessary to isolate movement and investigate the effects of movement alone on judgements of perceived vulnerability. Grayson and Stein did not attempt to isolate movement, or to

control for other target variables such as appearance, clothing, footwear, and race. Without these controls, it is difficult to conclude that respondents were attending to walking style when making their vulnerability ratings, especially since past research on variables such as appearance, clothing, and footwear has revealed such features to influence perceptions of vulnerability to attack (Nakdimen, 1984; Sinclair, 1973). While Murzynski and Degelman (1996) attempted to control for clothing and attractiveness, they too neglected to isolate movement. In order to properly test the hypothesis that walking style can specify vulnerability, and in turn provide a test of the ecological approach in a social domain, an appropriate methodology that isolated movement cues needed to be employed. The point light technique (Johansson, 1973) provided just such a rigorous methodology.

***POINT LIGHT METHODS.***

The point-light technique is a methodology sympathetic to the tenets of the ecological approach. The technique involves attaching reflective patches to the main joints of participants who are dressed in tight fitting black lycra clothing. This clothing serves to minimise possible variations in movement due to the clothing, whilst enabling a free range of movement. The participants are then flooded with light from spotlights mounted close to a video camera and videotaped performing a specified activity. Once videotaping is completed, the videotape is played back on a television monitor with the contrast setting maximised and the brightness setting minimised. The resultant picture is simply a configuration of moving lights without the presence of body shape, or structure.

This technique allows for the separation of structural and transformational invariants

and their effects on perception. During an event, "certain properties of an entity will change...whereas others remain the same" (McArthur & Baron, 1983, p. 216). The elements that remain unchanged during an event are called structural invariants. Examples of structural invariants include the shape of a car (which does not change as it is driven between two points), and a person's body contour (which does not change as they walk between two points). These elements remain constant regardless of the events involved. Transformational invariants, on the other hand, are the changing elements that may be evident in events. For example, postures and expressions change when people move about, interact, and communicate with others. Similarly, walking style, or kinematics, is a transformational invariant represented in the physical movement of all animals (McArthur & Baron, 1983). For people walking, the only available transformational invariant is movement. Point-lights serve to isolate the transformational invariant of movement by eliminating all structural invariants; movement is separated from body shape, clothing, and attractiveness. In this way, the ability of kinematic information (a transformational invariant) to specify vulnerability to attack can be assessed without any potentially confounds from structural invariants, such as body contour or appearance.

Johansson (1973) was the first to apply the point-light technique to complex event perception (Cutting, 1981), and discovered that the motion patterns provided by point-light displays convey all the information necessary for the rapid and accurate identification of human motion; motions such as walking, dancing, running, and climbing can be accurately identified and differentiated (Johansson, 1973). Johansson (1973) discovered that the recognition of human motion was accurate and spontaneous when filmed from various angles, but only if it was presented as a

dynamic display. Static images were insufficient for recognition of the human form. In a static image, point-lights were simply perceived as a random collection of lights (Johansson, 1975), and have often been described as resembling "constellations of stars or Christmas tree lights" (Kozlowski & Cutting, 1977, p.577). However, as soon as movement was introduced, the previously perceived random pattern of lights took on a meaningful configuration. In addition, the more vigorous the movements, and so the more dynamic information available (e.g., running, jumping), the more accurate the rate of identification (Runeson & Frykholm, 1983).

Since the introduction of the point-light methodology in kinematic studies other researchers have used this technique to identify properties of persons specified in action. Specified properties have included individual identity (Beardsworth & Buckner, 1981; Cutting & Kozlowski, 1977); category identity, such as sex (Cutting, Profitt, & Kozlowski, 1978; Kozlowski & Cutting, 1977; Runeson & Frykholm, 1983), and age (Montepare & Zebrowitz-McArthur, 1988; Montepare & Zebrowitz, 1993); activities, such as lifting, and throwing weights (Bingham, 1993; Runeson & Frykholm, 1981, 1983), and dancing (Walk & Homan, 1984).

Expectations and intentions, whether true or deceptive, can also been reliably detected from human motion patterns (Runeson & Frykholm, 1983). Runeson and Frykholm (1983) demonstrated that an actor's postural preadjustments and lead-in movements before lifting a box provided sufficient information to the observer as to the actual weight of that object; actors were unable to fool observers as to the actual weights of lifted boxes. Observers were reliably able to detect the true and the intended weight of the lifted box (Runeson & Frykholm, 1983). Similarly, actors were also unable to

successfully mask their true sex in their movements. Observers were able to discern actors' true sex, despite efforts made by the actors to move as if they were a member of the opposite sex (Runeson & Frykholm, 1983). Based on these results then, the issue of training targets to walk in particular ways (Murzynski & Degelman, 1996), ways that are not necessarily natural for them, deserves investigation.

Johansson's (1973) point-light technique has been very successful in providing evidence to support the contention that dynamics are specified in movement (Runeson & Frykholm, 1983). Results from these studies have found that in perceiving events, individuals actually perceive the dynamics, the underlying causes of patterns of movement, rather than the specific kinematic patterns themselves. That is, the properties of a target, such as their identity or sex, rather their specific movement patterns are perceived. For example, people are able to perceive a target's sex from point-light displays, however are unaware of the movement characteristics that distinguish male and female walks (Runeson & Frykholm, 1986). Males and females move distinctly because of the different distribution of bodily proportions of each sex (Bernstein, 1967; Krogman, 1962, cited in Runeson & Frykholm, 1986). Similarly, participants who are able to perceive and distinguish between targets in terms of vulnerability specified in gait, may be unaware of the impact of specific walking style characteristics on their vulnerability ratings. This lack of awareness was evident in Grayson and Stein's (1981) study, participants distinguished between targets on the basis of perceived vulnerability but were unable to report the characteristics upon which they based their vulnerability ratings.

The fact that perceivers were able to rapidly and accurately assess the configuration of

moving lights as representative of a moving human figure, and the fact that they could do this with no previous experience with point-light displays, led Johansson (1973, 1975) to suggest that perceptual ability, with respect to transformational invariants, is innate. In terms of the current research, it follows from these implications that the affordance of vulnerability is specified to perceivers in movement cues. When perceivers are instructed to attend to this affordance, sensitivity to these movement cues should be higher. Spontaneous perception of vulnerability may, however, depend on the goals and motivations of the perceiver, as is the case with individual attunements to any affordances in the environment. Evidence of individual differences in person perception has been found and necessitates further investigation (Beardsworth & Buckner, 1981). Spontaneous attunement to perceived vulnerability is not investigated in the present research.

Most studies have used between 10 and 12 points to depict human motion, although Johansson (1973) determined that 5 points, attached to the hip and legs, are sufficient for recognition of human locomotion. It also been established that although on-joint point-lights result in greater accuracy in recognising human motion, off-joint point-lights are adequate for the process (Cutting, 1981). Barclay, Cutting, and Kozlowski (1978) further contributed to our knowledge of point-light effectiveness by determining that point-lights must maintain their own separate integrity. When point-lights are blurred together, information regarding individual joint cues is lost, and observers are consequently unable to make certain judgements. For example, the accurate identification of sex was dependant on information from all major joints separately, specific joint relations are inherently informative.

Despite the number of studies conducted using the point-light method, very little attention has been paid to employing this method in a social domain. While studies have successfully isolated movement and studied interaction with physical objects (such as throwing weights and lifting boxes), they have not yet examined social interaction. Traditionally, social researchers have assumed the pick-up of relevant information and have focused on the inferential processes performed on that information, rather than investigating what information is attended to. The current study is important in extending the research of social psychologists into the area of considering what social information perceivers attend to, rather than considering only the inferential processes which may operate on that acquired information.

***THE PRESENT RESEARCH.***

The aim of the current study was to replicate and extend the findings of Grayson and Stein (1981), and Murzynski and Degelman (1996), investigating the role of movement cues in the specification of perceived vulnerability, but using an appropriate methodology. Although Grayson and Stein (1981), and Murzynski and Degelman (1996) obtained similar results, these two studies investigated different types of attack. The present study considered both rape and mug in a single study. In addition, the current research provided a test of the direct perception of a social event. Specifically, this study aimed to rigorously test the premise that walking style specifies ease of attack for perceivers, using point-light methodology. In this study, women were videotaped walking across a room using the point-light methodology. Male and female participants were then shown the videotape and rated each of the filmed women in terms of how easy or difficult each would be to mug and rape. The

walking styles of the women walkers were coded on the basis of 8 kinematic features, including the five features found to be significant in Grayson and Stein (1981), and three others: arm swing, energy, and constraint of walk. This research was reviewed and approved by the University of Canterbury Human Ethics Committee.

Although the focus of the current investigation was on target characteristics, one perpetrator characteristic was included. Two measures of sexual aggression, the Hostility Towards Women scale (Check, 1985) and the Rape Myth Acceptance scale (Burt, 1980) were administered to the male participants in order to assess the relationship between sexual aggression and ratings of ease of attack. The RMA was designed to assess culturally derived beliefs supportive of sexual aggression, while the HTW assesses individual's feelings of anger and hostility towards women. Men high in these characteristics are predisposed to behaving in sexually aggressive ways. The present research investigated whether males high in these characteristics would show a different pattern of judgements of the ease of attack of women compared to males low in these characteristics.

The following specific predictions for this study were made:

1) Based on the results obtained by Grayson and Stein (1981), Murzynski and Degelman (1996), and the KSD principle, it was predicted that participants would discriminate between walkers on the basis of ratings of ease of attack, and that there would be high agreement across participants.

2) Based on the theory of affordances, and the findings of Murzynski and Degelman (1996), it was predicted that there would be no difference between ratings of ease of attack made by male and female participants.

3) Based on the results obtained by Grayson and Stein (1981), it was predicted that some features of walking style would be predictive of ratings of ease of attack.

4) Based on the results obtained by Grayson and Stein (1981), it was predicted that participants would be unaware of the movement characteristics that influenced their ratings of perceived vulnerability.

5) It was predicted that male participants scoring highly on the Hostility Towards Women (HTW), and the Rape Myth Acceptance (RMA) scales would perceive all walkers as easier to mug and rape than male participants scoring relatively low on these scales. In other words, a strong positive correlation was predicted between scores on the HTW, and RMA, and overall ratings of ease of attack.

It is important to make two points clear at this stage. First, it is emphasised that the ability to detect an affordance does not equate to acting on that affordance. That is, the ability to perceive vulnerability to attack does not necessarily lead to the attack of vulnerable individuals. This separation between perception and action is especially likely in the present study, since the experimenter directed participants to attend to cues to ease of attack. Whether perceivers spontaneously attend to such information or

whether there are individual differences in attention (for example, whether offenders attend to that information but others do not) is not addressed in the present research. Second, it is stressed that the targets, and victims of crime in general, are not responsible for the crime(s) committed against them. Responsibility lies solely with the perpetrator who chooses to act on his/her perceptions. That somebody's movement style (or any other factor) specifies that they are especially vulnerable to physical attack does not excuse that attack. A more thorough understanding of the links between movement (and other visual properties) and perceived vulnerability is needed. It is hoped that the increased knowledge of specifiers of ease of attack gained from this research will lead women to change their walking styles, so that they do not specify vulnerability through their movement. The more that is known about high risk factors, such as walking style, the more able to avoid high risk situations individuals will be, and the easier it will be to provide effective safety campaigns to reduce the likelihood of attack.

# *Chapter 2: Method*

## *PART 1: VIDEOTAPING*

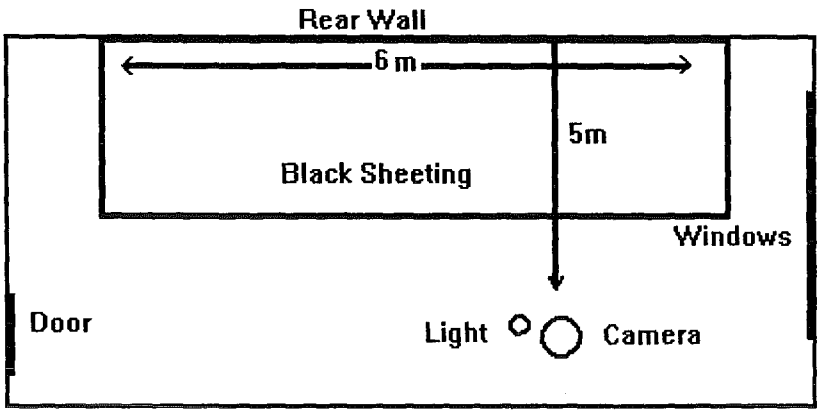
### Participants.

The participants were 71 women who volunteered to participate. The women were aged 18-52 years, were between 1.54 and 1.85 metres in height, weighed between 45 and 89 kilograms, and were predominantly of European/Pakeha origin (European/Pakeha, n = 68; Maori, n = 2; Asian, n = 1). They were recruited through advertisements around the University campus, in undergraduate Psychology classes, sports clubs, and through media coverage.

### Apparatus.

The filming apparatus was set up in a room in the Psychology Department as illustrated in Figure 2.1. Black sheeting, 6m wide, was fixed to the rear wall and spread out across the floor. All windows were fully blacked out. A National Portable black and white Video Camera, WV-3085, was positioned 5m from the rear wall (approximately 4.5m from the participants). A spotlight was mounted adjacent to the camera (25 cm from camera lens) facing the walking area. The camera was fixed in position on a tripod and did not pan to follow the participants. It was located off-centre, 1.3m from the right hand side of the black sheeting. The camera lens was 1.5m from the floor. The images were recorded on a Hitachi video system, VT-8E, and viewed on a JVC 14-inch television monitor.

Figure 2.1. Filming apparatus and set up.



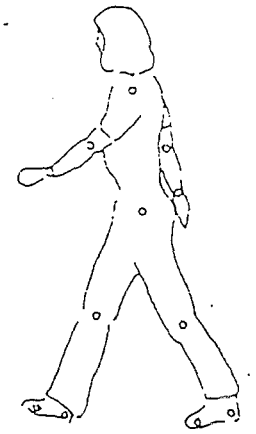

**Procedure.**

Participants were instructed to read an information sheet which informed them that the aim of the study was to investigate links between walking style and perceived vulnerability to attack. The women were told that they would be required to change into tight-fitting black lycra clothing and walk across the room a number of times whilst being videotaped. They were guaranteed complete anonymity and confidentiality. It was stressed that there was no way they would be able to be identified in the videotape segments, that all that would be visible would be the moving light patches attached to their body. The participants were all shown a video clip of somebody walking across the room in this manner to demonstrate the complete inability to recognise individuals from the videotape. The participants were also told that they could find out the overall results, and/or how their own walking style was rated by contacting the experimenter after the study was completed, quoting the individual identification number assigned to them at the time of videotaping.

After reading the information sheet participants were asked to answer questions about

their age, height, weight, and ethnicity. Participants then changed into the identical black lycra clothing provided: skivvy, leggings, socks, gloves, and a balaclava. Reflective tape cut into 40mm diameter circles was attached to the participants' joints by the experimenter, on the outside of joints on the left-hand side of the body, and the inside of joints on the right-hand side of the body. Twelve reflective tape circles were affixed (as illustrated in Figure 2.2) to the participant's moving joints (shoulder, elbows, hip, knees, and ankles), and limb extremities (wrists, and toes).

Figure 2.2. Illustration of the placement of reflective tape patches on walkers.



Participants were instructed to walk as naturally as possible, in a comfortable way, back and forth across the black sheeting four times. After a practice walk, walkers were informed that videotaping would begin. Participants were videotaped from a side view only. Both head and feet were in the camera shot at all times. After videotaping was completed, participants were thanked for their participation.

**Editing.**

Overall it took participants approximately 25-30 seconds to walk back and forth 4 times across the room, with an average of 7 steps in camera shot on each cross from

right to left. The raw recordings were edited. Each participant's first right to left cross in front of the camera and their left to right returns were edited out. As a result, the edited version showed each woman walking three times across the screen from right to left. Participant numbers and an 8 second space were edited into the tape between each woman.

Hereafter, these participants will be referred to as 'walkers'.

**Preliminary Study.**

Seven men watched the edited videotape on a 21-inch Panasonic colour television with the contrast turned up and the intensity/brightness turned down so that only the point-lights were visible. They rated each target according to how easy or difficult they thought they would be to mug and rape using a 10-point scale (1 = 'A very easy rip-off/rape'; 10 = 'Would avoid it, too big a situation. Too heavy'; taken from Grayson & Stein, 1981, see Appendix A). The participants noted that the rating task was too long, that they lost concentration and became fatigued. On the basis of this feedback the videotape was reduced in length. In doing so, a sample of walkers across the distribution of ratings was retained. The sample was therefore reduced to a total of 30 walkers: 12 targets with a mean rating of 6.5 or more (comparatively difficult to attack), 12 targets with a mean rating of 4.5 or less (comparatively easy to attack), and 6 with mean ratings of approximately 5.5 (neither especially difficult or especially easy).

The walkers in the final sample were aged between 18-52 years, were between 1.54 and 1.85 metres in height, weighed between 45 and 83 kilograms, and were all of

European/Pakeha origin. A comparison of the demographic characteristics of the initial population and the final sample revealed no significant differences between the two groups.

## *PART 2: RATINGS*

### Participants.

Thirty male and thirty female participants were recruited through advertisements at Employment Services, Student Job Search, on University noticeboards, and at Sports Clubs. Male participants were informed that the study would take approximately 30 minutes, and female participants that it would take 15 minutes. Both were offered the chance to win cash prizes of up to $50 or "scratch-and-win" tickets in a lucky dip in return for their participation. The research was conducted in a research laboratory in the Psychology Department at the University of Canterbury. Participants were tested individually or in pairs of the same sex.

### Materials.

Male Participants:

Three questionnaires were administered to the men after completing the rating task: Hostility Towards Women (HTW; Check, 1985), the Rape Myth Acceptance Scale (RMA; Burt, 1980), and a Rating Questionnaire (RQ) (see Appendix B for these scales). The HTW consisted of 30 true/false questions about feelings of anger and hostility towards women, and was scored out of a possible 30 points. A higher score on the HTW represented a high level of hostility towards women. The RMA consisted of 19 ratings on a 7-point scale about the degree of acceptance or rejection of myths about rape. The RMA was scored out of a possible 133 points, with reverse coding of

items as appropriate. Higher scores represented stronger acceptance of rape myths. The RQ asked participants to rate a number of walking features; speed, stride length, arm swing, weight shift, foot movement, whole body movement, and energy according to the extent which they thought each influenced their ratings of ease to attack (1 = 'not at all'; 5 = 'a lot'). In addition, an open-ended question asked participants to detail the advice they would give to somebody in order for them to walk confidently.

Female Participants:

Only the Rating Questionnaire (RQ, see Appendix B) was administered to the female participants.

**Procedure.**

The participant(s) sat at small table(s) in the research laboratory, approximately 2.5 metres from a 29-inch Panasonic television monitor. All participants read an information sheet which explained that the current study was investigating links between walking style and perceived vulnerability to attack. They were informed that they would be required to watch a videotape of thirty women walkers and rate each woman according to how easy or difficult they thought each one would be to mug and to rape. It was emphasized that the study was concerned with their perceptions of how easy these women would be to attack, and not the likelihood that they themselves would attack any of them. Participants were asked to familiarize themselves with the language and structure of the rape and mug scales, and were informed that there were no right or wrong answers, that all opinions and perceptions were valid and to make instinctive judgements as much as possible. Once participants felt familiar with the

scales, the lights were turned off and they watched the videotape, and rated each target according to how easy or difficult they thought each would be to mug and rape. The videotape was shown to the participants with the contrast turned up and the intensity/brightness turned down, so that only the point-lights were visible on the display.

After rating each of the 30 walkers, male participants answered the HTW, and RMA, followed by the RQ. The order of the HTW and the RMA was counterbalanced across participants. Female participants answered the RQ after completing the rating task.

Participants were thanked for their participation, and given their chance at the lucky dip. They were also informed that they could contact the experimenter for the overall results of this research if they wished to do so at a later date.

# *Chapter 3: Results*

For ease of comprehension and clarity, the ease of attack ratings for both mug and rape were reversed so that higher scores represented higher levels of perceived vulnerability. The results will be discussed in terms of ratings of perceived vulnerability, predicting vulnerability, whether raters know what they attend to, and whether background factors influence ease of attack ratings.

***PART 1: PERCEIVED VULNERABILITY.***

A 2 (sex of participant: male/female) X 2 (crime: mug/rape) X 30 (walker: 1-30) mixed model ANOVA with repeated measures on the second and third factors was conducted on participants' ratings of ease of attack. There was no significant main effect for sex of the participant. However, there was a significant main effect for type of crime, $F(1, 58) = 32.16$, $p<.001$, with walkers being perceived as more vulnerable to mug than to rape ($M$s = 6.06 vs. 5.44). There was also a significant main effect of walker, $F(29, 1682) = 21.82$, $p<.001$, with walkers being discriminated on the basis of ease of attack ratings; some walkers were perceived as easier to both mug and rape than others. There were no significant interaction effects.

These findings supported hypotheses 1 and 2. Participants were able to discriminate walkers on the basis of movement alone, and there was very high agreement across participants (hypothesis 1). There was no difference in the ratings made by male and female participants (hypothesis 2). In addition, all walkers were rated as easier to mug

than to rape, but there was a strong positive correlation between ratings of ease of attack for mug and rape for each walker.

Since the ANOVA revealed no significant differences between the male and female ratings, the scores were collapsed to a mean to give a single rape and mug rating for each walker. A Pearson product-moment correlation was then calculated between these mug and rape ratings. The correlation was very high ($r(30) = .99$), and as a consequence, mean scores were collapsed to form a single ease of attack score for each walker. The single ease of attack scores were used in the subsequent analyses.

## *PART 2: PREDICTING VULNERABILITY.*

### Coding of Walking Style Features:

Three independent raters coded each of the 30 walkers on eight kinematic features of walking style (see Appendix C): the five features identified by Grayson and Stein (1981), and three additional features. The additional features were included on the basis of discussions between the three raters, in whose opinion it was that the women's walking styles could be differentiated on more levels than those identified by Grayson and Stein (1981). Each walker was coded in terms of stride length (short, medium, or long); weight shift (primarily lateral, three-dimensional, up and down, or forward and back); type of walk (postural, gestural, or non-specific); and body movement (contralateral, or unilateral). Walkers were also rated on 5-point scales (1 = 'none'; 5 = 'a lot') in terms of what kind of foot movement they displayed (from swung through to lifted), and the amount of arm swing, energy, and constraint (that is, the degree to which a walker appeared tense) in their walking style. The speed of each

woman's walk (the mean time per step for each walker) was calculated from the videotapes.

Cronbach's alpha reliability coefficients were calculated across the 3 raters for each of the 8 coded walking features to establish internal consistency, and were as follows: stride length, $\alpha$=.623, weight shift, $\alpha$=.861, type of walk, $\alpha$=.765, body movement, $\alpha$=1.00, foot movement, $\alpha$=.781, arm swing, $\alpha$=.923, energy, $\alpha$=.898, constraint, $\alpha$=.879. Since the alpha reliability coefficients were so high, the mean rating for each of the features across the 3 raters for each target was calculated and used in the subsequent analyses.

**Predicting Vulnerability from Walking Style Features:**

The numerical kinematic features for each walker (foot movement, arm swing, energy, constraint, and speed) were correlated with the overall ease of attack mean score for each walker using Pearson Product Moment Correlations. All five numerical kinematic features were significantly correlated with walkers' overall ease of attack scores, as shown in Table 3.1. In addition to the correlations conducted for the numerical kinematic features, correlations were also performed for the walkers' demographic features: age, height, and weight. Of these, only weight was significantly correlated with ease of attack. Also apparent in Table 3.1 are the significant correlations between the kinematic features themselves, providing evidence that the walking style features are not independent of one another. It is also of note that there are only a couple of significant correlations between demographic features and walking style features (namely, weight and mean ease of attack, foot movement, and speed), indicating that movement features are not solely dictated by body structure.

Table 3.1. Pearson Product Moment Correlation matrix for walkers' overall ease of attack scores, numerical kinematic features, and demographic features.

| | Mean E. A. | Foot Mvnt | Arm Swing | Energy | Constraint | Speed | Age | Height | Weight |
|---|---|---|---|---|---|---|---|---|---|
| Mean E.A. | 1.00 | | | | | | | | |
| Foot Movement | -.77* | 1.00 | | | | | | | |
| Arm Swing | .65* | -.46* | 1.00 | | | | | | |
| Energy | .75* | -.60* | .61* | 1.00 | | | | | |
| Constraint | .42* | -.31 | .61* | .38* | 1.00 | | | | |
| Speed | -.60* | 0.33 | -.32 | -.66* | -.01 | 1.00 | | | |
| Age | .00 | -.23 | -.18 | -.00 | -.17 | .02 | 1.00 | | |
| Height | .09 | -.05 | -.03 | .09 | -.20 | -.03 | .10 | 1.00 | |
| Weight | .41* | -.40* | .21 | .22 | -.12 | -.37* | .07 | .48* | 1.00 |

E.A. = ease of attack

* significant at $p<.05$

A Multiple Regression analysis (with ratings of ease of attack as the dependant variable and the movement and demographic factors as the independent variables) was conducted in order to determine the relative predictive ability for ease of attack of each of these walking and demographic features. Eighty-two percent of the variance was accounted for by these variables. Only two features, foot movement ($\beta = .46$, $t = 3.72$, $p < .001$) and walking speed ($\beta = .28$, $t = 2.10$, $p < .05$) were independently predictive of ratings of ease of attack. That is, walkers who lifted their feet or walked slowly were rated as easier to attack than walkers who swung their feet or who walked quickly. The other characteristics, arm swing, energy, constraint, and weight were not independently predictive of ease of attack.

**Categorical Features:**

Single factor ANOVAs were conducted on the overall ease of attack scores for each

of the three categorical kinematic features: stride length (short, medium, long); weight shift (primarily lateral, three-dimensional, primarily forward/back); and type of walk (postural, gestural). Body movement was not included in the analysis as no variability was evident for this feature across the walkers; all walkers displayed a contralateral body movement.

Significant effects were discovered for each of the three categorical features; stride length, $F(2, 27) = 9.10$, $p < .001$; weight shift, $F(2, 27) = 7.47$, $p < .001$; and type of walk, $F(1, 28) = 5.57$, $p < .05$. Post-hoc analyses (Tukey, $p < .05$) were conducted on each variable. Walkers with short strides were perceived to be easier to attack than those with medium strides, who in turn were perceived as easier to attack than those with long strides (*M*s = 6.47, 5.59, and 4.48 respectively). Walkers exhibiting predominantly forward/back or lateral movement were perceived as equally easy to attack and both were perceived as easier to attack than walkers with 3-dimensional weight shifts (*M*s = 6.79, 6.31, and 5.25 respectively). For type of walk, women with gestural walks were seen as easier to attack than women with postural walking styles (*M*s = 6.43 and 5.46 respectively).

To summarise, hypothesis 3 was supported. Two features of walking style, foot movement and walking speed, were predictive of ratings of ease to attack.

**Prototypical Target Profiles:**

From the above analyses it is possible to formulate profiles of the 'prototypical easy to attack target' and the 'prototypical hard to attack target'. The five walkers with the highest overall ease of attack scores (range 6.63 – 6.85, $M = 6.76$) were selected to

devise the prototypical easy to attack profile, the five walkers with the lowest overall ease of attack scores (range 3.63 - 4.58, $M = 4.34$) made up the prototypical hard to attack profile, while the five walkers with the overall ease of attack scores closest to the overall mean (range 5.40 – 6.09, $M = 5.74$) made up the prototypical medium attack profile (see Appendix E for details of the walkers in each profile).

Single factor ANOVAs were conducted on each of the numerical features to test for significant differences between the prototypical easy, medium, and hard to attack target profiles. Means for all features for each of the prototypes are in Table 3.2. Significant effects were found for foot movement $F(2, 8) = 9.32$, $p < .01$, arm swing $F(2, 8) = 12.82$, $p < .01$, energy $F(2, 8) = 14.00$, $p < .01$, and speed $F(2, 8) = 7.54$, $p < .05$. Post-hoc analyses (Tukey, $p < .05$) were conducted on each of these four features. For arm swing, there was no difference between the easy and medium attack profiles, but both were lower than the hard to attack profile (*M*s = 2.67, 2.60, and 4.13 respectively). Similarly for energy, the easy and medium attack profiles did not differ, but both were lower than the hard to attack profile (*M*s = 2.53, 2.60, and 4.00 respectively). For both foot movement and speed, the easy and hard to attack profiles differed from each other, but did not differ from the medium attack profile (foot movement: *M*s = 3.40, 2.13, and 2.67 respectively; speed: *M*s = .479, .411, and .459 respectively). No significant differences were found for constraint, or weight. It is noteworthy that the prototypically easy to attack targets could only be differentiated from the prototypically medium attack walkers in terms of stride length.

Table 3.2. Mean ratings for walking style features and weight as a function of ease of attack.

| | Overall Sample Mean (N=30) | Easy to attack Target (N=5) | Medium attack Target (N=5) | Hard to attack Target (N=5) |
|---|---|---|---|---|
| Foot Movement | 2.70 | 3.40 | 2.67 | 2.13 |
| Arm Swing | 3.17 | 2.67 | 2.60 | 4.13 |
| Energy | 3.07 | 2.53 | 2.60 | 4.00 |
| Constraint | 2.93 | 2.40 | 2.73 | 3.27 |
| Speed (sec/step) | 0.448 | 0.479 | 0.459 | 0.411 |
| Weight (kg) | 61.7 | 55.4 | 59.8 | 68.2 |

From the categorical analyses discussed earlier, and the numerical analyses discussed above, prototypically easy to attack walkers could be characterised as walking with either short or medium stride lengths relative to their height, predominantly lateral weight shifts, and with either postural (3) or gestural (2) walking styles. They were also more likely to lift their feet, display limited arm swing, appear low in energy, appear constrained, walk relatively slowly, and weigh less than other walkers. This profile was very similar to the prototypical medium attack profile, although walkers in the latter profile were characterised as walking with a medium stride length. Prototypically hard to attack targets formed a much more distinct group. These walkers displayed medium or long strides relative to their height, 3-dimensional weight shifts, and postural walks. They were more likely to swing their feet, display a full range of arm swing, appear energetic, appear unconstrained, walk relatively fast, and weigh relatively more than other walkers.

***PART 3: PERCEIVER AWARENESS.***

Participants were asked to rate the extent to which they believed that 7 specific walking style characteristics influenced their mug and rape ratings on a 5-point scale (1 = 'very slightly or not at all'; 5 = 'extremely'). A 2 (sex: male/female) X 7

(walking style features: stride length/weight shift/whole body/foot movement/arm swing/energy/speed) ANOVA with repeated measures on the second factor was performed, in order to determine what walking style features participants' thought influenced their ratings of ease of attack. There was a main effect of sex, $F(1, 58) = 5.08$, $p<.05$. Female participants rated all 7 features as more influential than did male participants, (*M*s = 3.39 vs. 3.03). There was also a main effect of feature, $F(6, 348) = 27.44$, $p<.001$. Participants rated the walking style features to be most predictive in terms of ease of attack in the following order: energy ($M = 4.03$); speed ($M = 3.90$); stride length ($M = 3.53$); arm swing ($M = 3.38$); whole body movement (type of walk) ($M = 3.25$); weight shift ($M = 2.77$); and foot movement ($M = 2.28$) as displayed in Table 3.3. Post hoc analysis (Tukey, $p<.05$) revealed 14 of the 21 comparisons to be significant (see Appendix F)

Also shown in Table 3.3 is the actual order of importance of the kinematic features as reflected in the participants' ease of attack ratings (note: this list is limited to the numerical walking style features; it does not include the categorical features, hence the lack of complete overlap between the two lists). A comparison of the actual order of importance and the perceived order of importance reveals mixed results. Whilst participants were accurate in predicting that speed was an important determinant with respect to ease of attack, they were inaccurate with regard to foot movement, rating this as least important.

Table 3.3. The order of importance of kinematic features.

| Perceived Order of Importance | | Actual Order of Importance |
|---|---|---|
| Energy | 1 | Foot Movement |
| Speed | 2 | Speed |
| Stride Length | 3 | Arm Swing |
| Arm Swing | 4 | Constraint |
| Whole Body | 5 | Energy |
| Weight Shift | 6 | Weight |
| Foot Movement | 7 | |

Responses to the question, "If you had to tell someone how to walk confidently, what types of things would you tell that person?" were assessed for references to the coded walking style features. The most frequent reference was made to speed (62% of participants), followed by arm swing (35%), stride length (33%), whole body movement (12%), and energy (8%). In addition, 38% of participants made some reference to overall posture, such as having a straight back, holding the head up and keeping the shoulders back, as being an important component of a confident walk. No references were made to weight shift, constraint, or foot movement. In addition to the coded walking style features, references were often made to less tangible characteristics, such as possessing a confident attitude (23%), a sense of awareness (22%), and a sense of purpose (13%).

To summarise, hypothesis 4 was partially supported. Participants displayed limited awareness as to the extent to which different walking style features influenced their ratings of ease of attack. Walking speed was the only factor which participants identified as particularly important to ease of attack ratings. The favoured response of

speed was again highlighted in the answer to the open-ended question.

***PART 4: BACKGROUND FACTORS.***

Two measures of sexual aggression were administered to the male participants in order to examine the hypothesized relationship between aggression and ease of attack ratings (hypothesis 5): the Rape Myth Acceptance Scale (RMA) and, the Hostility Towards Women Scale (HTW).

Pearson product moment correlations were calculated for male participants' mug and rape ratings for all 30 targets and their RMA and HTW scores. None of the results were statistically significant (RMA: mug $r(30) = -.004$; rape $r(30) = -.32$; HTW: mug $r(30) = -.27$; rape $r(30) = -.35$). Hence, there was no relation between levels of sexual aggression, as measured by the RMA and HTW, and ratings of ease of attack. Consequently, no support was found for hypothesis 5.

***SUMMARY OF RESULTS.***

To summarise:

(i) Participants were able to differentiate walkers on the basis of ease of attack solely from movement cues, and there was a high level of agreement between participants (hypothesis 1);

(ii) No difference was found between ratings of ease of attack made by male and female participants (hypothesis 2).

(iii) Some walking style features, specifically walking speed, and foot movement, were predictive of ease of attack ratings (hypothesis 3);

(iv) Participants were not very accurate at assessing what features were influential to their ease of attack ratings (hypothesis 4);

(v) No relationship between predictors of sexual aggression (HTW and RMA) and ratings of ease of attack was revealed (hypothesis 5).

# *Chapter 4: Discussion*

## *PERCEIVING VULNERABILITY.*

The current study demonstrated that both male and female participants were able to differentiate female walkers in terms of ease of attack, solely on the basis of movement cues (hypothesis 1 and 2). That is, participants consistently identified some walkers as easier to attack than others. Overall, participants rated the walkers as easier to mug than to rape. However, across walkers there was a very strong relationship between mug and rape ratings; those walkers considered hardest to rape were also judged hardest to mug, and so on.

Using an appropriate and rigorous methodology, the point-light technique (Johansson, 1973), the present study was able to demonstrate that ease of attack was indeed specified in movement. These results offered support for the claims made by Grayson and Stein (1981), and Murzynski and Degelman (1996) that vulnerability to attack is specified in walking style. Certain walking styles afford attacking, whilst others do not.

The ecological approach, from which the theory of direct perception and the theory of affordances have been derived, has provided a strong theoretical framework within which these results can be interpreted. The present research has extended the application of the ecological approach to social perception. The consensus across participants in the ability to detect ease of attack, and the lack of difference between male and female perceivers, provides support for the theory of direct perception. The

theory of direct perception states that affordances are available to be perceived by everyone, but that individual attunement dictates the detection of affordances. Ease of attack, a characteristic previously believed to be hidden, was shown to be directly perceivable. Other qualities previously considered to be hidden may also be directly perceivable, from movement or other cues. In this study, perceivers' attunement to ease of attack was maximised since they were instructed to attend to it.

***PREDICTING VULNERABILITY.***

In order to identify those kinematic features that specified ease of attack, eight features of walking style were coded for each walker and regressed on to ratings of ease of attack. Foot movement and speed were the only features that were independently predictive of the ratings of ease to attack (hypothesis 3). Lifted feet and/or a relatively slow walk predicted higher ratings of ease of attack than swung feet and/or a relatively quick walk. A number of other features (stride length, weight shift, type of walk, arm swing, energy, constraint, and weight) were also shown to be correlated with ratings of ease of attack. Many of these features (e.g., foot movement, stride length, weight shift, and type of walk) were also demonstrated by Grayson and Stein (1981) to be associated with perceived vulnerability, however the current study has extended this association to include speed, energy, arm swing, constraint, and weight.

Importantly, ease of attack was primarily associated with features of walking style rather than with gross physical features of the walkers (height, weight, and age); there was only a weak positive correlation between ease of attack and the weight of the walkers. Walking style was also largely unrelated to physical features; there were no

significant correlations between either age or height of walkers, and any of the walking style features, and only moderate negative correlations between weight, and foot movement and walking speed. Therefore, it appears that ease of attack is specified by walking style, and not by walkers' gross physical features.

In addition, the walking style features were interdependent; that is, the degree or presence of each feature was related to the degree or presence of many of the other kinematic features (see Table 3.1). For example, a walker who swung her feet, also swung her arms, walked energetically, and weighed relatively less than a walker who lifted her feet. The interdependence of these features led to the development of prototypical profiles for walkers who were rated easy and hard to attack. The prototypical hard to attack walker was characterised by a longer stride length, swinging foot movement, a bigger range of arm swing, more energy, less constraint, a faster walk, and a relatively heavier body weight than easy to attack walkers. They also moved posturally, with a three-dimensional weight shift, whereas easy to attack walkers moved either posturally or gesturally, and with a predominantly lateral weight shift. These profiles were very similar to those developed by Grayson and Stein (1981). The hard to attack prototype was characterised by the same features, except for stride length (identified by Grayson and Stein as medium, compared to medium-long in the present study). For the easy to attack profile, the prototypes only differed with respect to stride length (identified as short in Grayson and Stein, compared to short-medium in the present study), and body movement (identified as predominantly unilateral by Grayson and Stein, however no examples of unilateral movement were recorded in the present study).

Interestingly, the prototypically hard to attack walking style was found to be a more distinctive style of walking than the easy to attack walking style. The prototypically hard to attack profile was differentiated from the easy to attack profile in terms of foot movement, arm swing, energy, and speed, and from the medium attack profile in terms of arm swing, and speed. The prototypically easy to attack profile was not differentiated from the medium attack profile on any of the above factors. Therefore, it appears that the hard to attack group are walking more 'safely' than the other groups.

That certain walking style characteristics are predictive of ratings of ease of attack is consistent with the theory of affordances, which asserts that certain properties of objects in the environment afford action and interaction opportunities to the perceiver. For example, a sharp instrument affords stabbing or piercing, while a small moveable object affords throwing. The results of the present investigation demonstrated that lifted feet and a relatively slow pace of walking afford easy attack to the perceivers. The theory of affordances states that affordances remain constant, are always available to be perceived. Therefore, whilst individual walkers may learn to change their walking styles, to be perceived as less vulnerable to attack, the presence of lifted feet, and a slow gait in any other walker will remain predictive of perceived vulnerability to attack.

The current investigation has demonstrated that certain walking style features afford attacking to perceivers. A practical implication of this result is that changing walking style should lead to a change in the walkers' perceived vulnerability to physical attack. Whether individuals can change their walking style and adopt those features

which specify low perceived vulnerability to attack is unclear and awaits further research. Proponents of the *Alexander Technique* (Bunn, 1996), and other movement specialists believe that it is possible to consciously change unconscious movement patterns. The deception literature, however, casts doubt on whether such changes are effective. For example, attempts made by actors to conceal their sex by mimicking the walking style of the opposite sex were detected by perceivers (Runeson & Frykholm, 1983) as were attempts to deceive observers about weight of lifted objects through variations in lifting style (Runeson & Frykholm, 1983). The success of changes in movement style may depend on the features which are changed; some aspects of walking style may be easier to change, and hence more convincing, than others. It is important to note that the critical features ease of attack are associated with walking style and are not constrained by physical features, such as age, weight, and height. Consequently, these movement features should be more receptive to change than if they had been fettered by such body dimensions. Nevertheless the ability of people to adopt walking styles which specify low vulnerability deserves further study. If it is indeed possible to train individuals to adopt particular walking styles, these assumed styles could be used in a number of ways. It would be possible to train individuals to walk in a manner that lessened their chances of being perceived as vulnerable. Conversely, exaggerating the walking style features most predictive of high perceived vulnerability to attack could be used by police decoys to increase their chances of enticing and trapping would-be offenders.

***PERCEIVER AWARENESS.***

Although participants were able to discriminate between walkers in terms of ease of attack, they were largely unable to identify the walking style features that influenced

their ratings of ease of attack (hypothesis 4). These results are consistent with the KSD Principle which holds that perceivers discern the dynamics of an event (such as ease of attack), rather than the movements underlying these dynamics, such as foot movement, or walking speed.

A comparison of the kinematic features which participants thought influenced their ratings of ease of attack and those features that were found to be predictive of these ratings revealed a large difference on one of the features found to be predictive of ratings, that is foot movement. Participants considered foot movement to be the least influential factor, when in fact it was the strongest predictor of actual ratings. Participants were more accurate with respect to the influence of speed on their ratings, correctly regarded as the second most influential component. Interestingly, female participants perceived all 7 of the kinematic features to be more influential overall on their ease of attack ratings than the male participants. It is possible that the focus of the investigation, that is, attacks against female targets perpetrated by males, could have heightened female participants' sensitivity to the issue of vulnerability to attack and cues which may signal such vulnerability.

Participants' open-ended descriptions of a confident walking style also highlighted speed as a salient factor, but no participants mentioned foot movement. Participants' impressions of the important features may be reflective of a common notion that to walk safely is to walk at pace and with vigour, or energy. For example, in a guide to being safe on Campus distributed by the University of Canterbury Students Association, common sense walking guidelines include the tip "Walk at a steady pace and with confidence" (UCSA, 1996). As such, the idea that speed and energy are

important to a walker's safety may already be accessible to participants' perceptions of vulnerability. Additionally, these factors are relatively easy to detect in walking style.

The lack of awareness exhibited by the respondents emphasizes the need for systematic research, such as the present study, which investigates the features specifying the dynamics of an event. If individuals are to be encouraged to change their walking styles in an attempt to reduce their vulnerability to attack, it is important that they are made aware of which features it would be most beneficial to alter, rather than them changing those features which they believed influence perceptions of vulnerability.

***BACKGROUND FACTORS.***

It was hypothesised that there would be a relationship between measures of sexual aggression and ratings of ease of attack for male participants (hypothesis 5). The data did not, however, support this prediction; the correlations between the measures of sexual aggression and ratings of ease of attack were low and non-significant. Although hypothesis 5 was not supported, these results are consistent with the theory of direct perception. The theory of direct perception holds that affordances are constant, but that their detection is dependent on the perceiver; sensitivity varies as a function of perceivers' permanent and temporary characteristics. In this study, it is likely that participants' sensitivity to vulnerability was increased by the specific experimental instructions which directed their attention to this affordance, and consequently all participants were able to detect the affordance of vulnerability specified in movement. It is possible, however, when perceivers attention is not

specifically drawn to ease of attack, that is, in spontaneous attention situations, individual attunement to perceived vulnerability may vary according to factors such as levels of sexual aggression.

It is also noteworthy that the theory of direct perception argues that the perception of an affordance provides an opportunity for action and interaction, but that the perception of an affordance does not necessarily cause a perceiver to take up this opportunity. In this case, the ability to perceive vulnerability from walking style provides an opportunity to attack, but it does not mean that the perceiver will act on this opportunity. Whether perceivers choose to act upon this perception may, again, be influenced by such factors as level of sexual aggression.

In summary, using a rigorous methodology, the current research has demonstrated that men and women are capable of differentiating female walkers on the basis of ease of attack from walking style cues alone when their attention is focused on the detection of this affordance. It also demonstrated that some walking style features, (namely foot movement, and walking speed) are independently predictive of ease of attack. In doing so, this study has supported and strengthened Grayson and Stein's (1981), and Murzynski and Degelman's (1996) contention that vulnerability to attack can be specified in movement. In addition, it was demonstrated that perceivers have only a limited awareness of the walking style factors which influenced their ratings of ease of attack, and that levels of sexual aggression had no impact on male participants' ratings of ease of attack. Finally, the current study has provided a theoretical framework for the perception of vulnerability to attack.

The present research was framed in terms of the ecological approach and the KSD Principle for two reasons. First, past research failed to provide a theoretical framework for the interpretation of their results, hence leading to a less systematic approach to research in this domain, as well as a lack of generalisation. Second, the lack of social perception research from an ecological perspective, and specifically the dearth of systematic investigation into the features specifying the information directly available in the social domain, signalled the need for an extension of the ecological perspective into social perception research. The consistency of the present results with predictions derived from the ecological approach provided strong support for this extension.

### *LIMITATIONS OF CURRENT RESEARCH.*

There are some limitations of the current research that need addressing. First, the point-light method is an unusual one for participants since they are required to dress in tight-fitting clothes and perform activities with reflective patches attached to their joints whilst being video-taped. It is possible that this unusual behaviour causes self-consciousness or embarrassment in the walkers which may result in some alteration in their movements (Runeson & Frykholm, 1983). The movement under investigation in this study, walking, is so well learned and participants were shown a demonstration videotape prior to participation, so any effects of the method should be minimised. An alternative and less intrusive technique for isolating movement from extraneous variables such as physical appearance, attractiveness, and facial expressions (Berry, Kean, Misovich, & Baron, 1991), is the dynamic quantization technique. This technique degrades the standard videotape picture by using a special effects generator at the time of editing, but the resultant display is blurred and as such reveals less detail

of movement patterns than the point-light method. Future research using the point-light technique should ensure that participants are comfortable and familiar with the technique, and could also include ratings of walkers' self-consciousness and confidence, in order to control for any effects that these variables may have on walking style.

Second, the order of presentation of the walkers on the videotape was the same for all participants in the present study. It is, therefore, possible that fatigue and/or anchoring effects influenced the ratings of some walkers. The first walker (number 4) to be viewed, for example, received a medium overall ease of attack rating, which may have been due to the lack of any comparison. Future research needs to vary the order of stimulus presentation to avoid any such effects.

Third, the current study only considered female walkers. However, as males are more at risk from some types of physical attack than females, such as assault (van Dijk et al., 1990), future research should also consider the perceived vulnerability of male walkers. It should be determined whether male walkers can also be differentiated on the basis of ease of attack from movement cues alone, and whether the same kinematic cues are predictive of ratings of ease to attack, as for females.

As detailed above, it is also important to note that the findings of the present study can only be generalised to situations in which individuals are directed to focus their attention on how easy or difficult walkers would be to attack. The current investigation does not speak to whether individuals are attuned to the affordance of vulnerability spontaneously, or whether that attunement is a function of situational

and/or personality factors. It is only possible to conclude that perceivers are capable of attending to the cues which specify ease of attack when asked to do so. This conclusion is consistent with the ecological approach which holds that affordances are constant, that they are always available to be perceived, and that everyone is capable of perceiving affordances if sensitive to them. However, individual levels of attunement or sensitivity vary, which may produce a different pattern of results for perceptions of vulnerability in spontaneous attention situations.

It is unfortunate that a more complete comparison of the actual versus perceived importance of walking style features could not be achieved in the present study. The categorical walking style features which participants rated for importance were not included in the comparison, since they were not given a numerical value by the coders who evaluated the walking styles of each of the 30 walkers. It would have been possible to convert the categorical features into numerical variables, but meaning would have been lost. For example, changing weight shift into a numerical variable would have resulted in a mean of 1.60 (for the medium attack profile group), roughly half way between a lateral and a 3-d weight shift, which is not representative of any specific weight shift style.

***DIRECTIONS OF FUTURE RESEARCH.***

The current research effectively provides a baseline for research on the perception of vulnerability. Although the current study has demonstrated that movement alone is sufficient to specify ease of attack, perceivers do not typically perceive movement in isolation. It is important to extend the present research by considering the effects of additional visual properties (such as clothing, and footwear) on perceived

vulnerability. Past research has shown that such cues can influence judgements of vulnerability. For example, women wearing 'revealing' clothing are more vulnerable to attack than those wearing 'concealing' outfits (Marshall & Barbaree, 1990). Footwear also has an effect on walking style. High heels effectively shift body weight forward, often disturbing whole body posture from the pelvis through to the spine, and thus influencing walking style (Sinclair, 1973) which in turn may influence perceptions of vulnerability. Similarly, Nakdimen (1984) noted that high heeled shoes, especially boots increase height and subsequently perceptions of authority. For a fuller understanding of the perception of vulnerability to physical attack the interrelationship between movement cues which specify vulnerability and these additional visual cues need to be known. For example, does wearing revealing clothing or high heels overrule a walking style associated with low perceived vulnerability.

Although the current study focused on victim characteristics, research investigating situational and individual differences (e.g., offender characteristics), which may also influence judgements of perceived vulnerability, is equally important. Predictors of sexual aggression were incorporated in the present study, but other variables, such as sensitivity to nonverbal communication and attachment styles, may also be influential in terms of perceivers' sensitivity and ability to differentiate kinematic information. The spontaneous perception of vulnerability is another important factor to be considered. With respect to situational factors, geographical location, social context, and involvement in specified activities may influence perceptions of vulnerability. It would be interesting, for example, to examine whether some situations result in perceivers being more likely to perceive vulnerability, and also whether some

situations/locations result in higher ratings of perceived vulnerability for all walkers. All of these factors require further investigation with a view eventually integrating all of these foci of research.

It is hoped that future research will build on the results of the current investigation, providing useful information in terms of the general understanding of the differential impact of visual, situational, and individual factors, determining whether such cues are additive or interactive. An increased knowledge of the factors which specify perceived vulnerability may enable individuals to lower perceptions of their own vulnerability, to avoid high risk situations, and could lead to the introduction of safety campaigns aimed at reducing the likelihood of attack.

## *CONCLUSIONS.*

The present investigation rigorously tested Grayson and Stein's (1981) contention that vulnerability to physical attack could be specified by walking style. Using the point-light methodology, the current study found support for this contention, and extended the research to include issues of perceiver self-awareness and perceiver characteristics. The present study found that perceivers were able to differentiate between walkers on the basis of ratings of ease of attack when directed to, that specific features of walking style (foot movement and speed) were predictive of ratings of ease of attack, that perceivers had little awareness as to the walking style factors which influenced their ratings of ease of attack, and that no relationship was evident between male perceivers' ratings of ease of attack and measures of sexual aggression. These results demonstrate that some women are perceived as walking more safely than others, and suggest that it may be beneficial for others to adopt this

safer style of walking. The efficacy of adopting different walking styles also requires investigation, with a view to reducing the potential for physical attack and ensuring a safer environment for women. Future research should consider whether it is possible to change walking style, and if so, whether this has an effect on ratings of ease of attack as predicted. Future research should also look to generalise these results to the perceived vulnerability of male walkers, as well as identifying other cues which specify vulnerability, such as clothing and footwear. Attention must also be directed towards identifying individual differences and situational factors influencing vulnerability. The present study has demonstrated that the ecological approach provides a strong theoretical framework within which to interpret the current results, and has extended the application of the ecological approach to social perception.

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# *Appendices*

## Appendix A
Rape and Mug Scales

**Using the following 'Rape Scale', please rate how easy or difficult this women would be to rape.**

### Rape Scale

| *Description* | *Rating* |
|---|---|
| A very easy rape | 1 |
| An easy woman to corner | 2 |
| You could take her on | 3 |
| Looks like a fairly easy target | 4 |
| You could stand the problem | 5 |
| Could give you a little static | 6 |
| Would be a problem. Could give you a hard time. | 7 |
| Hard woman to knock off. Wouldn't mess with her. | 8 |
| Would be heavy. Would give you a hard time. | 9 |
| Would avoid it, too big a situation. Too heavy. | 10 |

**Using the following 'Mugging Scale', please rate how easy or difficult this woman would be to mug.**

### Mugging Scale

| *Description* | *Rating* |
|---|---|
| A very easy rip-off | 1 |
| An easy woman to corner | 2 |
| You could take her on | 3 |
| Looks like a fairly easy target | 4 |
| You could stand the problem | 5 |
| Could give you a little static | 6 |
| Would be a problem. Could give you a hard time. | 7 |
| Hard woman to knock off. Wouldn't mess with her. | 8 |
| Would be heavy. Would give you a hard time. | 9 |
| Would avoid it, too big a situation. Too heavy. | 10 |

# Appendix B

HTW

This questionnaire is designed to assess your feelings toward women. Thus, all of the statements on this page refer to women. Please read each statement carefully and circle "T" (True) if the statement describes your feelings and "F" (False) if the statement does not describe your feelings or if you disagree with it.

| | | |
|---|---|---|
| 1) I feel that many times women flirt with men just to tease them or hurt them. | T | F |
| 2) I feel upset even by slight criticism by a woman. | T | F |
| 3) It doesn't really bother me when women tease me about my faults. | T | F |
| 4) I used to think that most women told the truth, but now I know otherwise. | T | F |
| 5) I do not believe that women will walk all over you if you aren't willing to fight. | T | F |
| 6) I do not often find myself disagreeing with women. | T | F |
| 7) I do very few things to women that make me feel remorseful afterward. | T | F |
| 8) I rarely become suspicious with women who are more friendly than I expect. | T | F |
| 9) There are a number of females who seem to dislike me very much. | T | F |
| 10) I don't agree that women always seem to get the breaks. | T | F |
| 11) I don't seem to get what's coming to me in my relationships with women. | T | F |
| 12) I generally don't get really angry when a woman makes fun of me. | T | F |
| 13) Women irritate me a great deal more than they are aware of. | T | F |
| 14) If I let women see the way that I feel, they would probably consider me a hard person to get along with. | T | F |
| 15) Lately, I have been kind of grouchy with women. | T | F |
| 16) I think that most women would not lie to get ahead. | T | F |
| 17) It is safer not to trust women. | T | F |
| 18) When it really comes down to it, a lot of women are deceitful. | T | F |
| 19) I am not easily angered by a woman. | T | F |
| 20) I often feel that women probably think I have not lived the right kind of life. | T | F |
| 21) I never have hostile feelings that make me feel ashamed of myself later. | T | F |
| 22) Many times a woman appears to care, but just wants to use you. | T | F |
| 23) I am sure I get a raw deal from the women in my life. | T | F |
| 24) I don't usually wonder what hidden reason a woman may have for doing | | |

| | | |
|---|---|---|
| something nice for me. | T | F |
| 25) If women had not had it in for me, I would have been more successful in my personal relations with them. | T | F |
| 26) I never have the feeling that women laugh about me. | T | F |
| 27) Very few women talk about me behind my back. | T | F |
| 28) When I look back at what's happened to me, I don't feel at all resentful toward the women in my life. | T | F |
| 29) I never sulk when a woman makes me angry. | T | F |
| 30) I have been rejected by too many women in my life. | T | F |

RMA

For the statements which follow, please circle the number that best indicates your opinion – what you believe. If you strongly disagree, you would answer "1"; if you strongly agree, you would answer "7"; if you feel neutral, you would answer "4"; and so on.

| | disagree strongly | | | neutral | | | agree strongly |
|---|---|---|---|---|---|---|---|
| 1) A woman who goes to the home or apartment of a man on their first date implies that she is willing to have sex. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2) Any female can get raped. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 3) One reason that women falsely report a rape is that they frequently have a need to call attention to themselves. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4) Any healthy woman can successfully resist a rapist if she really wants to. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5) When women go around braless or wearing short skirts or tight tops, they are just asking for trouble. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6) Women who get raped while hitch-hiking get what they deserve. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7) A woman who is stuck-up and thinks she is too good to talk to guys on the street deserves to be taught a lesson. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8) Many women have an unconscious wish to be raped, and may then unconsciously set up a situation in which they are likely to be attacked. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9) If a woman gets drunk at a party and has intercourse with a man she's just met there, she should be considered "fair game" to other males at the party to have sex with her too, whether she wants to or not. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10) In the majority of rapes, the victim is promiscuous or has a bad reputation. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11) If a girl engages in necking or petting and she lets things get out of hand, it is her fault if her partner forces sex on her. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Please use the following key to answer the next two questions.

| | almost none | | | about half | | | almost all |
|---|---|---|---|---|---|---|---|
| 12) What percentage of women who report a rape would you say are lying because they are angry and want to get back at the man they accuse? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 13) What percentage of reported rapes would you guess were merely invented by women who discovered they were pregnant and wanted to protect their own reputation? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Please use the following key to answer the next question.

| | never | | | half the time | | | always |
|---|---|---|---|---|---|---|---|
| 14) A person comes to you and claims they were raped. How likely would you be to believe their statement if the person were: Your best friend? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15) A Maori woman? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16) A neighbourhood woman? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17) A young buy? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 18) A Polynesian woman? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 19) A white woman? | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

## RATING QUESTIONNAIRE

*Instructions:* The following questionnaire is designed to help interpret the data collected from the mug and rape ratings of the women on the video tape. This questionnaire is anonymous and confidential. Please answer the questions honestly.

---

**1. The scale below consists of a number of words that describe the extent to which you believe that specific walking style characteristics influenced your mug and rape ratings. Read each characteristic and then mark the appropriate number in the space next to that characteristic.**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| very slightly or not at all | a little | moderately | quite a bit | extremely |

_____ **speed of walk**
_____ **stride length**
_____ **amount of arm swing**
_____ **the shifting of weight from one foot to the other**
_____ **confidence of walk**
_____ **shoulder position**
_____ **foot movement (i.e., swung versus lifted)**
_____ **height of woman**
_____ **smoothness of walk**
_____ **incorporation of whole body in walking movement**
_____ **energy of walk**

**2. If you had to tell someone how to walk confidently, what types of things would you tell that person?**

**END OF STUDY**
**THANKS FOR YOUR PARTICIPATION**

## Appendix C

# Walking Style Coding Sheet

Potential Victim #____ **Coder:**_____

---

**1. Stride Length:** Distance measured by a step.

*Short* *Medium* *Long*

**2. Type of Weight Shift:** The shift that occurs when transferring weight from one foot to the other while walking. Movement usually starts at the pelvis.

*Primary lateral*: weight shifted from side to side

*Three-dimensional*: pelvis operates in a spiral and achieves a three-dimensional quality

*Primarily up/down*: weight shift causes a bounce because body goes up and down

*Primarily forward/back*: a sagittal movement

**3. Type of Walk:**

*Postural*: movement activates the whole body

*Gestural*: movement activates only a part of body

*Non-specific*: other

**4. Body Movement:**

*Unilateral*: one side of the body or one limb used

*Contralateral*: two sides of body move in counterpoint-right arm, left leg then left arm, right leg

**5. Feet:**

1 2 3 4 5
*Swung* *Lifted*

**6. Arm Swing:**

1 2 3 4 5
*None* *Full Range*

**7. Energy of Walk:**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| *Lethargic* | | | | *Vigorous* |

**8. Level of Constraint:**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| *Inhibited* | | | | *Loose* |

# Appendix D

## Grayson & Stein's (1981) Labananalysis movement code

**1. STRIDE LENGTH:** Distance measured by a step.
**Short** **Medium** **Long**

**2. STRIDE WIDTH:**
**Wide:** stride extends beyond hip joint
**Narrow:** within boundaries of hip joint

**3. KNEES:**
**Bent** **Straight**

**4. TEMPO:** Number of steps in five seconds

**5. TYPE OF PHASE:** A movement that has an exertion–recuperating rhythm which tends to organise itself into phases that initiate, make a main statement and conclude. A series of movements comprising a section of a pattern. Scoring indicates where in phase emphasis occurs:
**Explosive:** beginning
**Swing:** middle
**Impacted:** end

**6. RELATION TO UPRIGHTNESS:** Body's relationship to gravity in space.
**Vertical**
**Horizontal**
**Saggital** (back and forth)
**Neutral** (erect, upright without any spatial stress)

**7. TYPE OF WEIGHT SHIFT:** The shift that occurs when transferring weight from one foot to the other while walking. Movement usually starts at the pelvis.
**Primarily lateral:** weight shifted from side to side
**Three-dimensional:** pelvis operates in a spiral and achieves a three-dimensional quality
**Primarily up/down:** weight shift causes a bounce because body goes up and down
**Primarily forward/back:** a sagittal movement

**8. TYPE OF WALK:**
**Postural:** movement activates the whole body
**Gestural:** movement activates only a part of body
**Non-specific:** other

**9. TYPE OF ENERGY:**
**Held:** energy retained in body
**Relaxed:** energy permitted to flow easily
**Non-specific:** other

**10. AMOUNT OF ENERGY:** Relative amounts of energy used.
**Low** **High**

**11. USE OF WHOLE BODY:**
**Mainly lower moves:** body moves from waist down, upper body held
**Upper vs. lower:** upper and lower parts move separately, sometimes in opposition to each other
**Variations in rhythm:** no continuous pattern in body movement

**12. BODY MOVEMENT:**
**Unilateral:** one side of body or one limb used
**Contralateral:** two sides of body move in counterpoint – right arm, left leg then left arm, right leg

**13. HEAD:**
**Undifferentiated:** head moves as unit with spine
**Gestural:** head moves as a separate unit in relation to the spine

**14. GAZE:**
**Straight ahead** **Down** **Non-specific**

**15. FEET:**
**Swung** **Lifted**

**16. LEFT ARM TYPE OF MOVEMENT:**
**Swung** **Other**

**17. LEFT ARM AMOUNT MOVED:**
**Whole** **Part**

**18. LEFT ARM HOLD:**
**Held** **Relaxed**

**19. RIGHT ARM TYPE OF MOVEMENT:**
**Swung** **Other**

**20. RIGHT ARM AMOUNT MOVED:**
**Whole** **Part**

**21. RIGHT ARM HOLD:**
**Held** **Relaxed**

# Appendix E

Walker characteristics for the prototypically easy, medium, and hard to attack walking profiles.

| Walker characteristics for the prototypically easy to attack profile | | | | | | |
|---|---|---|---|---|---|---|
| | Walker Number | | | | | |
| **Kinematic Feature** | 13 | 22 | 23 | 31 | 56 | Mean |
| Stride Length | medium | medium | medium | short | short | short-med |
| Weight Shift | lateral | lateral | three-dim. | for/back | lateral | pred. lateral |
| Type of Walk | postural | gestural | postural | postural | gestural | post(3)/gest(2) |
| Foot Movement | 2.67 | 3.33 | 3.00 | 4.00 | 4.00 | 3.40 |
| Arm Swing | 2.33 | 3.00 | 3.00 | 3.00 | 2.00 | 2.67 |
| Energy | 2.00 | 2.67 | 3.00 | 2.00 | 3.00 | 2.53 |
| Constraint | 2.00 | 2.00 | 3.00 | 4.00 | 1.00 | 2.40 |
| Speed (sec/step) | 0.508 | 0.488 | 0.455 | 0.515 | 0.413 | 0.479 |
| Weight (kg) | 59 | 51 | 45 | 50 | 72 | 55.4 |

| Walker characteristics for the prototypically hard to attack profile | | | | | | |
|---|---|---|---|---|---|---|
| | Walker Number | | | | | |
| **Kinematic Feature** | 21 | 35 | 50 | 53 | 67 | Mean |
| Stride Length | long | medium | medium | long | medium | medium-long |
| Weight Shift | three-dim. | three-dim. | three-dim. | three-dim. | three-dim. | three-dim. |
| Type of Walk | postural | postural | postural | postural | postural | postural |
| Foot Movement | 2.00 | 2.33 | 2.00 | 1.67 | 2.67 | 2.13 |
| Arm Swing | 4.33 | 3.00 | 4.00 | 4.67 | 4.67 | 4.13 |
| Energy | 4.33 | 4.00 | 4.00 | 4.33 | 3.33 | 4.00 |
| Constraint | 3.67 | 3.33 | 3.00 | 3.33 | 3.00 | 3.27 |
| Speed (sec/step) | 0.408 | 0.403 | 0.425 | 0.407 | 0.41 | 0.411 |
| Weight (kg) | 65 | 55 | 83 | 63 | 75 | 68.2 |

| Walker characteristics for the prototypically medium attack profile | | | | | | |
|---|---|---|---|---|---|---|
| | Walker Number | | | | | |
| **Kinematic Feature** | 4 | 36 | 49 | 58 | 71 | Mean |
| Stride Length | medium | medium | medium | medium | medium | medium |
| Weight Shift | lateral | lateral | three-dim. | three-dim. | three-dim. | 3-d (3)/lat(2) |
| Type of Walk | postural | postural | postural | postural | gestural | pred. postural |
| Foot Movement | 2.00 | 3.00 | 3.00 | 3.00 | 2.33 | 2.67 |
| Arm Swing | 2.67 | 2.00 | 2.33 | 3.00 | 3.00 | 2.60 |
| Energy | 3.00 | 3.00 | 2.67 | 2.33 | 2.00 | 2.60 |
| Constraint | 3.00 | 3.00 | 2.33 | 3.33 | 2.00 | 2.73 |
| Speed (sec/step) | 0.497 | 0.417 | 0.463 | 0.478 | 0.44 | 0.459 |
| Weight (kg) | 51 | 51 | 55 | 62.5 | 79.5 | 59.8 |

# Appendix F

## Tukey Post hoc analysis for 2 x 7 ANOVA of Rater Awareness

| | Speed M = 3.90 | Stride M = 3.53 | Arms M = 3.38 | W/Shift M = 2.77 | Feet M = 2.28 | W/ Body M = 3.25 | Energy M = 4.03 |
|---|---|---|---|---|---|---|---|
| Speed | | | | | | | |
| Stride | .293463 | | | | | | |
| Arms | .031368* | .972462 | | | | | |
| W/Shift | .000026* | .000104* | .003971* | | | | |
| Feet | .000026* | .000026* | .000026* | .056656 | | | |
| W/Body | .001822* | .614267 | .984923 | .056656 | .000026* | | |
| Energy | .984923 | .042424* | .001822* | .000026* | .000026* | .000073* | |

* significant at $p<.05$